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Armed Forces
Radiobiology Research Institute
and AFRRI Reactor Facility

Emergency Plan

June 1993

Docket 50-170

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Armed Forces Radiobiology Research Institute
8901 Wisconsin Avenue
Bethesda, Maryland 20889-5603

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This guide supports or is supported by the following AFRRRI instructions:

3000.4 series	Reactor Division Organization and Functions
3020.2 series	Emergency Evacuation
5200.8 series	AFRRRI Security Plan
5230.1 series	Public Affairs Guidance in Case of a Nuclear Incident
6055.8 series	Occupational Radiation Protection Program
M82-1	Operations Manual for AFRRRI TRIGA

This plan replaces the "Emergency Plan for the Armed Forces Radiobiology Research Institute and the AFRRRI Reactor Facility" dated February 1991.

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Emergency Plan for the Armed Forces Radiobiology Research Institute and AFRRI Reactor Facility

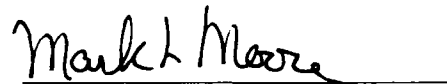
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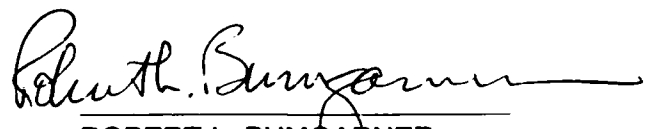
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Preface

This emergency plan was prepared in accordance with the following regulations and instruction:

Code of Federal Regulations, Title 10, Part 50, Appendix E, November 30, 1988.

Emergency Planning for Research and Test Reactors, USNRC Regulatory Guide 2.6, March 1983.

Emergency Planning for Research and Test Reactor, ANSI/ANS 15.16, 1982.

Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors, NUREG-0849, October 1983.

AFRRI Instruction 3000.4 series, Reactor Division Organization and Functions.

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this emergency plan is to set forth the organizational structure and define the general functions of the Armed Forces Radiobiology Research Institute (AFRRI) emergency response organization. Specific procedures for dealing with emergency conditions that may arise at AFRRI are established in the AFRRI Emergency Response Guidebook.

1.2 SCOPE

This plan applies to all personnel who have been tasked with the responsibility of responding to potentially hazardous situations that may require emergency actions. These situations include, but are not limited to the following:

- Radiation emergencies involving the TRIGA reactor, or any other radiation source at AFRRI
- Fires in the facility
- Releases of nonradioactive hazardous materials (HAZMAT) within the facility
- Personnel injuries
- Threats of civil disturbance (bomb threats, etc.)
- Natural disasters and physical plant malfunctions

For emergency situations that extend beyond the AFRRI site boundary and do not involve the reactor, the National Naval Medical Center (NNMC) Disaster Preparedness Plan will take precedence.

1.3 AFRRI FACILITY AND SITE DESCRIPTION

AFRRI is a tri-service military organization (subordinate to the Defense Nuclear Agency (DNA); effective 1 October 1993, subordinate to the Uniformed Services University of Health Sciences (USUHS)). AFRRI is responsible for conducting scientific research in the field of radiobiology and related matters essential to the operational and medical support of the Department of Defense (DoD) and the military services. The entire AFRRI facility is comprised of several interconnected buildings. It houses three major radiation sources and various intermediate and low-level radiation sources.

Site Description. FRRI is located in the southwest quadrant of NNMC. It is bounded on the south by Palmer Road South, on the west and north by Stone Lake Road, and on the east by a circular arc extending from Stone Lake Road to the northernmost corner of the AFRRI "N" parking lot area, clockwise to the intersection of Palmer Road South and Grier Road (figure 1-1). Within this area, AFRRI has jurisdiction and control of activities.

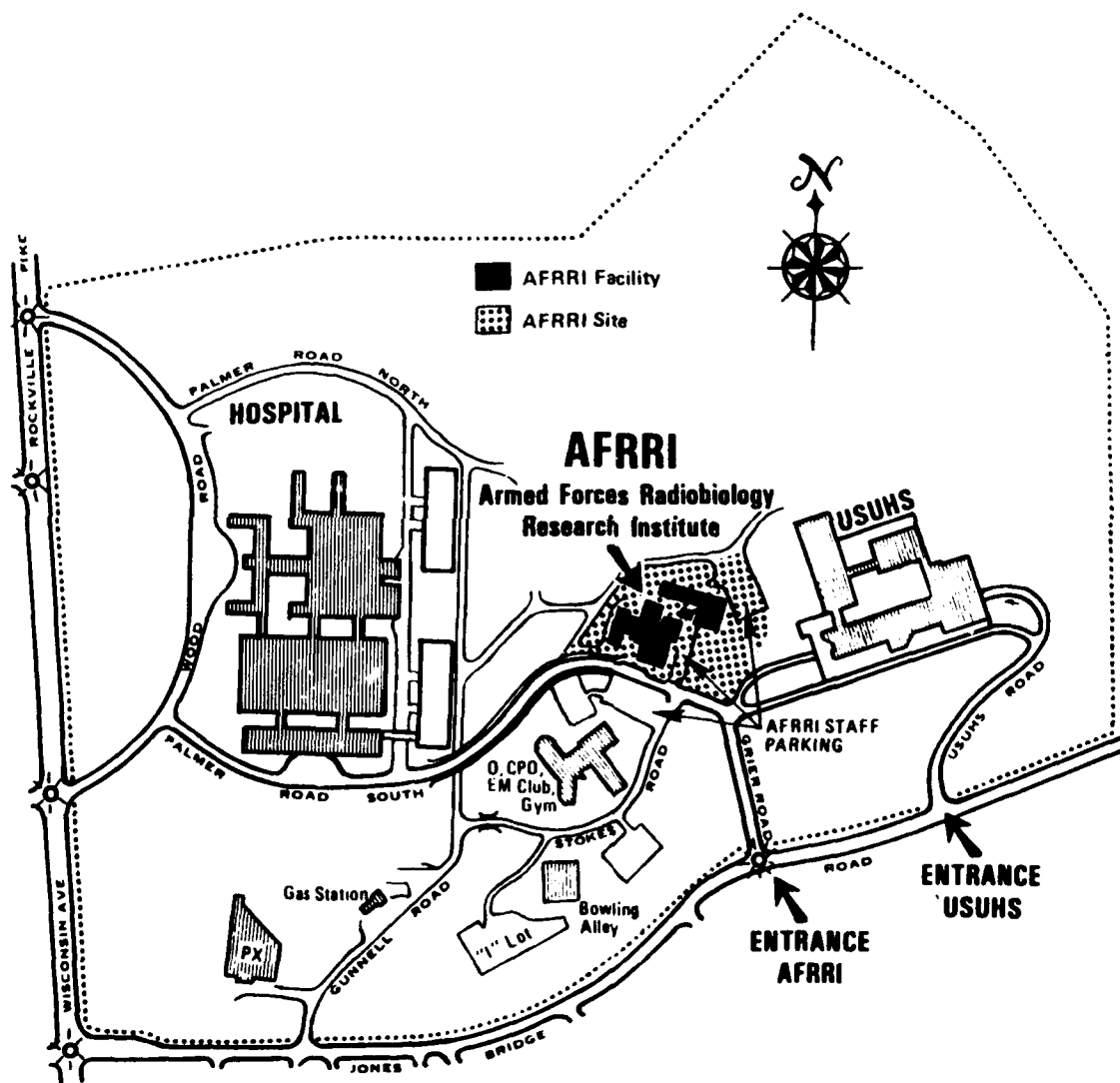


Figure 1-1. AFRRI site.

Facility Description. The three major radiation sources at AFRRRI are the TRIGA Mark-F reactor, a 500,000 curie (maximum) cobalt-60 source, and a linear accelerator (LINAC). The intermediate level radiation sources are a cobalt-60 theratron, and a 3-curie californium-252 source. Various other low-level radioactive materials are maintained throughout AFRRRI in accordance with U.S. Nuclear Regulatory Commission (USNRC) licenses.

The reactor is housed in building 42A. The reactor is a TRIGA (Training, Research, Isotope, General Atomic) Mark-F pool-type research reactor operated under USNRC License Number R-84. It is capable of both pulsed and steady-state operation.

The reactor core is light-water cooled and graphite/water moderated and reflected. Its fuel elements contain a homogeneous mixture of uranium-zirconium hydride, which is 8.5% uranium by weight and has a hydrogen to zirconium ratio of 1.7. The fuel is enriched to less than 20% in the uranium-235 isotope. These fuel elements are placed in a closely packed circular array and are submerged under a minimum of 14.5 feet of water. The reactor has an authorized maximum steady-state thermal power of 1.1 MW and may be pulsed to a peak power of over 3000 MW.

In addition to the reactor, the reactor facility also has various unique exposure facilities that may be used with the reactor operating in either the steady-state or pulse mode. The exposure facilities available for use include two large dry exposure rooms, a pneumatic tube system, an in-core experiment tube, the pool itself, and 18 small holes in the upper grid plate of the reactor core.

Credible accidents, including Design Basis Accidents (DBAs), for the reactor are discussed in the AFRRRI Reactor Facility Safety Analysis Report (SAR). The worst postulated radiation accident would stem from the rupture of the cladding of a spent fuel element outside of the reactor pool. The calculated whole-body dose at the AFRRRI site boundary is less than 1.3 mrad. More details on the radiological consequences of DBAs can be found in the SAR.

1.4 REACTOR OPERATING ORGANIZATION

The organization of personnel for managing and operating the reactor facility is shown in figure 1-2. Organization changes may occur, based on requirements, and they will be described in internal documents. However, no changes may be made in the Operation, Safety, and Emergency Control Chain in which the reactor facility director has direct responsibility to the director of AFRRI.

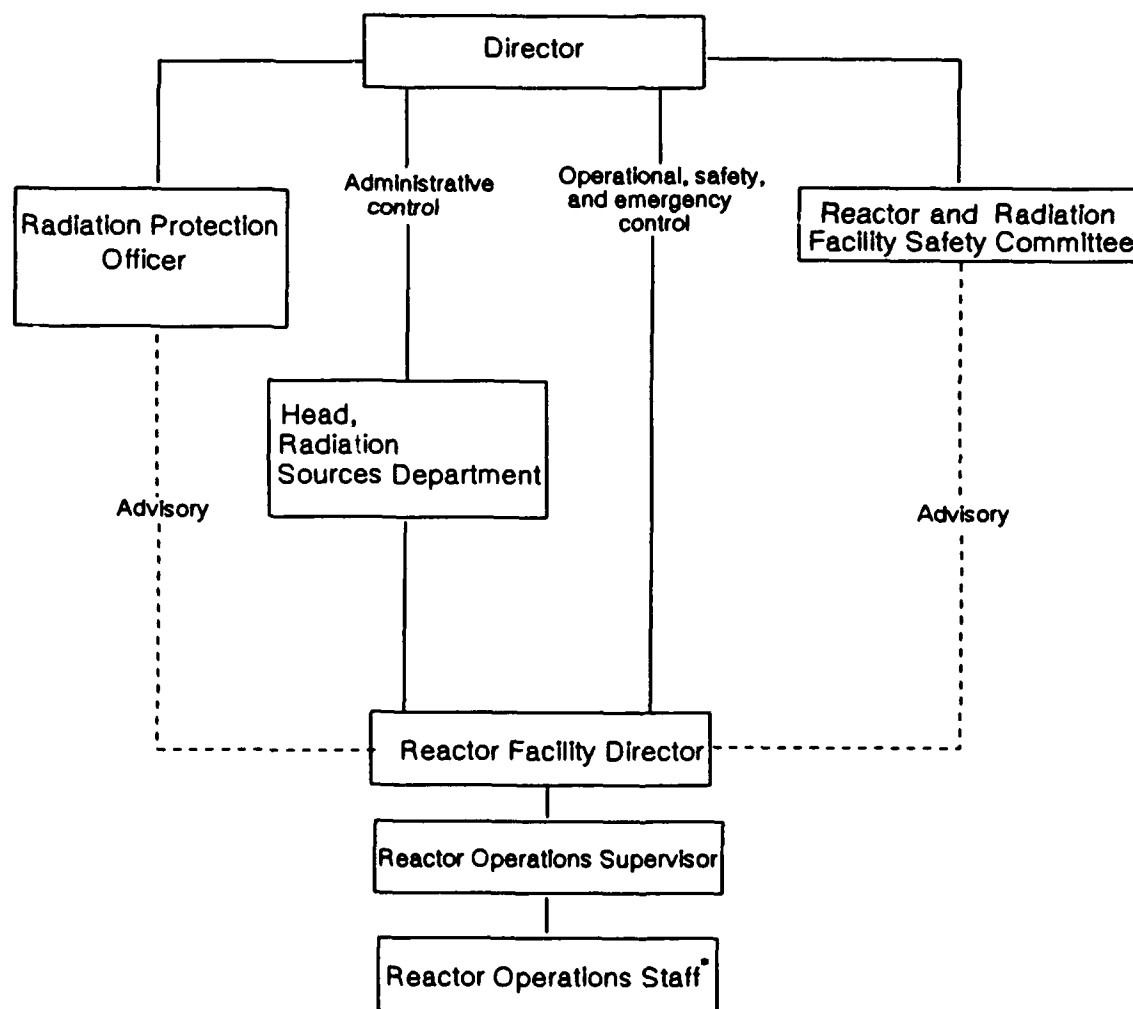


Figure 1-2. Organization of personnel for management and operation of the reactor facility.

*Any reactor staff member has access to the director of AFRRI for matters of safety.

2.0 DEFINITIONS

There must be a common understanding of the terminology used by all members of the organization for an emergency response organization to function effectively. This chapter defines the terms used throughout this emergency plan and the accompanying AFRRI Emergency Response Guidebook.

AFRRI

Armed Forces Radiobiology Research Institute, which is also referred to as the Institute.

AFRRI EMERGENCY RESPONSE GUIDEBOOK

A guidebook containing emergency action procedures, emergency organization personnel rosters, training guidelines, facility maps, and special facility instructions. This guidebook may be revised to reflect changes in manning emergency organization billets, facility requirement, or in improving emergency action or training procedures.

AFRRI FACILITY

All of the buildings, appurtenances, and facilities of AFRRI in appendix A of the AFRRI Emergency Response Guidebook.

AFRRI REACTOR FACILITY OPERATIONS BOUNDARY

Areas within the AFRRI reactor facility operations boundary encompass all areas related to the reactor facility formed by physical barriers (walls, floor, roof, doors) to the following areas within the reactor building: reactor administration/control area (rooms 3106 and 3155-3162); upper reactor equipment room (room 3152); lower equipment room (room 2158); radiochemistry laboratory (room 2165); hot cell (room 2166); conference room and office (rooms 2164 and 2164a); warm storage (rooms 1120 and 1121); exposure room 1 (room 1123); exposure room 2 (room 1122); and the reactor prep area (room 1105). A potential radiological hazard exists or could exist in these areas. A diagram that illustrates the AFRRI reactor facility operations boundary is included in appendix B of the AFRRI Emergency Response Guidebook.

AFRRI SITE

The geographical area within the AFRRI site boundary.

AFRRI SITE BOUNDARY

Confines of the AFRRI site as illustrated in figure 1-1.

ASSESSMENT ACTIONS

Those actions taken during or after an emergency situation to obtain and process information that is necessary to make decisions to implement specific emergency or recovery operations.

CORRECTIVE ACTIONS

Those measures taken to diminish or terminate an emergency situation at or near the source of the problem in order to prevent or reduce the magnitude of a release of radioactive material under an emergency situation or to prevent or reduce the consequences of an accident.

EMERGENCY

A condition that calls for immediate action beyond the scope of normal operating procedures to avoid an accident or to mitigate the consequences of one.

EMERGENCY ACTION LEVELS (EALs)

Specific reactor-related instrument readings or observations; radiological dose or dose rates; specific contamination levels of airborne, waterborne, or surface-deposited radioactive materials; or other events that may impact AFRRI or the reactor. These EALs are used as thresholds for establishing emergency classes and initiating appropriate emergency measures or procedures.

EMERGENCY CLASSES

Generally accepted classifications for emergency situations grouped by severity level for which predetermined emergency measures or procedures have been addressed, considered, or provided.

EMERGENCY COMMAND POST (ECP)

A designated location from which the ECP commander directs emergency responses and actions be taken. The ECP is the emergency coordination and decision center.

ECP COMMANDER

The ECP commander has overall responsibility and final approval authority for all actions taken on-site during an emergency or recovery operation.

EMERGENCY COORDINATOR

The emergency coordinator is responsible for ensuring adequate emergency preparedness. This includes coordinating this emergency plan with off-site agencies, planning and critiquing exercises, and periodically reviewing and updating this emergency plan and the AFRRI Emergency Response Guidebook.

EMERGENCY DRILL

A drill that tests the integrated capability of the emergency organization or a component thereof. It may include instruction periods to develop and maintain skills in a particular operation.

EMERGENCY PLAN

A document that establishes necessary emergency organization and provides the basis for actions to cope with an emergency.

EMERGENCY PLANNING ZONE (EPZ)

Area in which emergency planning is performed to ensure that prompt and effective actions can be taken to protect the public in the event of an accident. The EPZ size is established by the maximum distance within the AFRRI site boundary at which the protective action guide (PAG) is determined to be met.

EMERGENCY RESPONSE CENTER

Location (room 3430) for storing emergency equipment and supplies.

EMERGENCY RESPONSE TEAM (ERT) COMMANDER

The ERT commander is the primary implementation arm of the emergency organization for assessment and corrective/protective action taken specifically within the confines of AFRRI during an emergency or recovery operation. The ERT commander is also responsible for providing emergency data, interpreting data, advice, and assistance, as necessary, to the ECP commander for decision making during an emergency or recovery operation.

EMERGENCY RESPONSE TEAM (ERT) LOCATION

Designated location for acquiring emergency status information and for assessment and corrective/protective action decisions made at the ECP.

NNMC (also referred to as the POST, BASE, or CENTER)

National Naval Medical Center as illustrated in figure 1-1.

OFF-SITE

The geographical area that is beyond the AFRRI site boundary.

ON-SITE

The geographical area that is within the AFRRI site boundary.

PROTECTIVE ACTION

Those measures taken in anticipation of an uncontrolled release of radioactive material or after an uncontrolled release of radioactive material has occurred to prevent or minimize personnel radiation doses or dose commitments that would otherwise be likely to occur if action was not taken.

PROTECTIVE ACTION GUIDES (PAGs)

Projected radiological dose or dose commitment to individuals that warrant protective action following a release of radiological material. Protective action would be warranted provided the reduction in individual dose expected to be achieved by carrying out the protective action is not offset by excessive risks to individual safety in taking the protective action. The projected dose does not include the dose that has unavoidably occurred prior to the assessment. The AFRRI SAR demonstrates that the USNRC Regulatory Guide 2.6 levels of 500 mrem whole body or 1 rem thyroid can not be reached at the AFRRI site boundary for any credible accident conditions.

RADIONUCLIDE AND X-RAY SAFETY COMMITTEE (RXSC)

A committee that provides oversight and review over AFRRI's byproduct licenses.

REACTOR AND RADIATION FACILITY SAFETY COMMITTEE (RRFSC)

A body of individuals from within and outside of AFRRI responsible to the director for overseeing, reviewing, and monitoring all operations, procedures, activities, and systems/structures associated with the major radiation sources to ensure safety and regulatory compliance.

RECOVERY ACTION

Action taken after the emergency to restore the facility to a safe status.

3.0 ORGANIZATION AND RESPONSIBILITIES

This chapter describes the organization and responsibilities of the emergency response organization, including interactions with off-site governmental agencies. The information presented here pertains to any class of emergency. Specific responsibilities and emergency response actions are described in greater detail in the AFRRI Emergency Response Guidebook.

3.1 ON-SITE EMERGENCY RESPONSE ORGANIZATION

The function of the emergency organization is to respond to any emergency situation that may arise at AFRRI. Radiological and hazardous materials emergencies are the primary focus of the emergency organization due to the unique processes at AFRRI that use radiation and potentially hazardous chemicals. The minimum working emergency organization shall consist of the ECP commander and the ERT commander. Additional AFRRI manpower and resources and local support agencies shall be available and can be called into service by the ECP commander or ERT commander, as deemed necessary. The AFRRI emergency organization is shown in figure 3-1. Interaction between the AFRRI emergency organization and off-site support agencies is discussed in section 3.2 of this chapter.

The emergency organization is divided into two major groups: the ECP and the ERT. In generic terms, the ECP is the emergency coordination and decision center while the ERT is the action and implementation group. The following sections outline the authorities, responsibilities, and general duties of the members of the emergency organization. All billets in the emergency organization shall be filled prior to an emergency; however, if assigned personnel are not available at the time of an emergency, the ECP commander has the authority to assign personnel present to fill any empty billets.

3.1.1 ECP PERSONNEL RESPONSIBILITIES AND DUTIES

ECP Commander

The director is the ECP commander. The ECP commander directs the activities of the ECP and has overall responsibility for the safety of all personnel on-site and for the Institute during an emergency or recovery operation. The ECP commander has final approval authority for all actions taken on-site during an emergency or recovery operation, including downgrading and terminating emergencies. In addition, the ECP commander is responsible for ensuring outside agencies are notified, requesting any needed NNMC or other off-site emergency support, and authorizing any planned on-site personnel radiation exposures in excess of 10 CFR 20 limits during an

emergency or recovery operation as necessary. The ECP commander is the final approval authority for any public information releases during or following emergency recovery actions if the Public Affairs Office (PAO) of higher authority is unavailable.

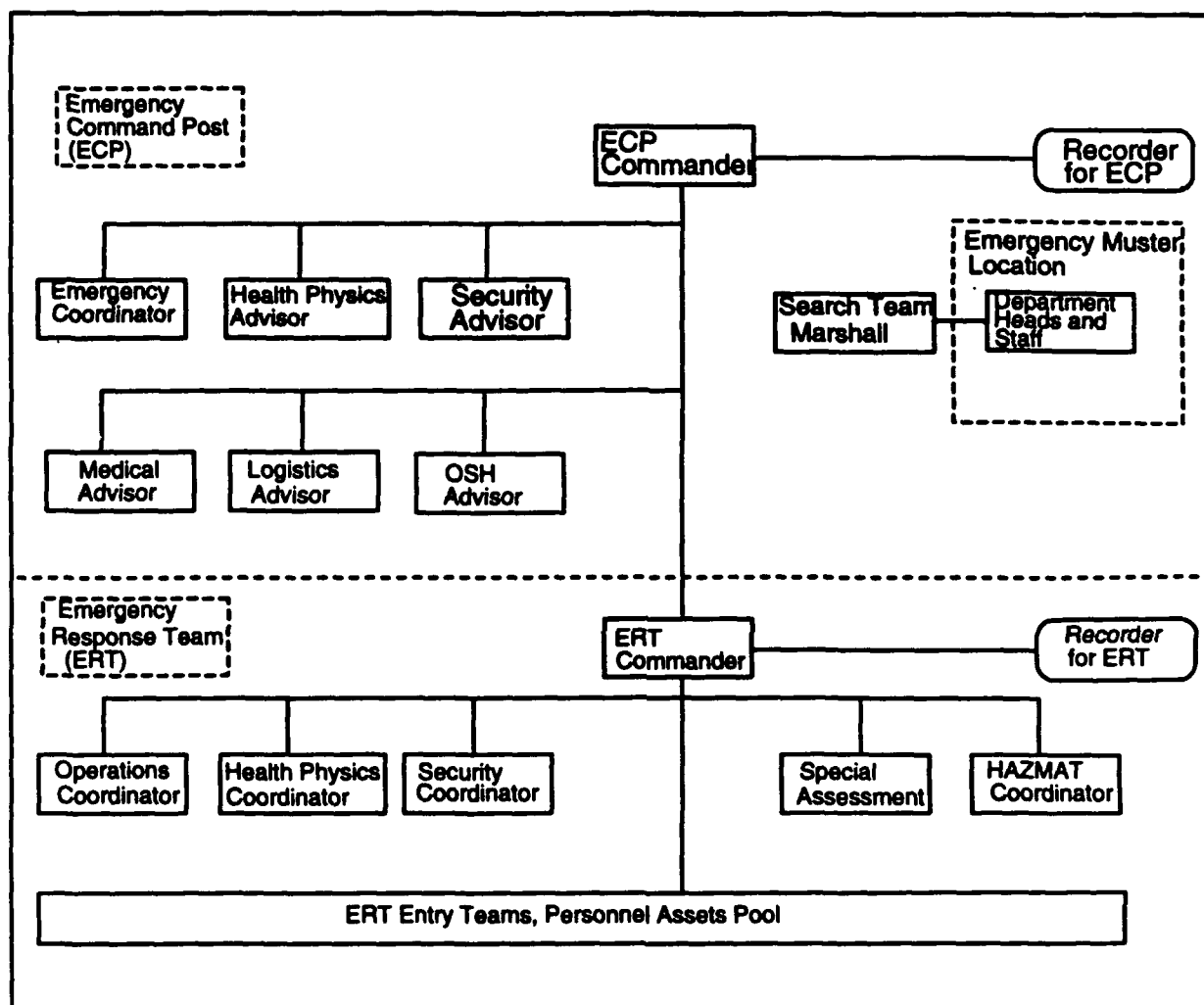
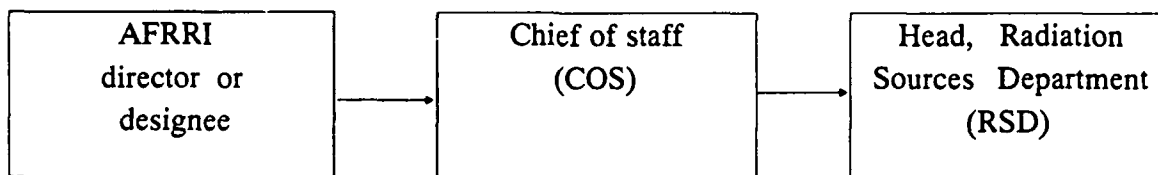


Figure 3-1. AFRRI emergency organization.

The line of succession and responsibilities of the ECP commander are as follows:

a) Line of succession



b) Responsibilities

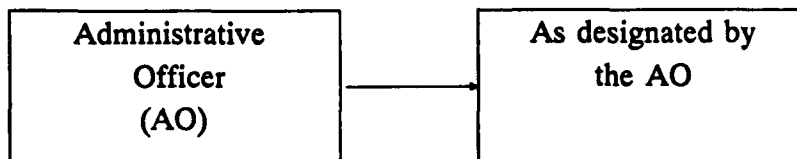
- i) Direct emergency operations and ensure proper implementation of the emergency plan and the emergency procedures in the AFRRI Emergency Response Guidebook.
- ii) Ensure that necessary USNRC, higher authority, and NNMC notifications are made.
- iii) If necessary, authorize emergency workers to incur radiation exposures in excess of 10 CFR 20 occupational limits, with the concurrence of the health physics advisor, if available. **This function cannot be delegated.**
- iv) Ensure that radiation/radiological assessment actions are carried out, that emergency assessment is made, and that corrective/protective action is implemented by the ERT commander as necessary.
- v) Terminate an emergency, and initiate recovery operations based on advice from the ERT commander and other support staff.

The ECP commander may call upon all manpower, services, and equipment resources available within AFRRI, through the Interservice Support Agreement with NNMC, or from other sources and apply them as necessary on-site. To accomplish this, the ECP commander may delegate authority for certain operations to the ERT commander or designee.

Emergency Coordinator

The administrative officer is the emergency coordinator.

a) Line of succession



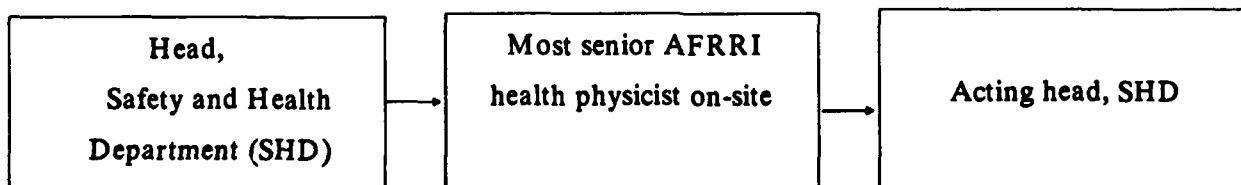
b) Responsibilities

- i) Fulfill any necessary requirements for notifying the USNRC, higher authority, NNMCC, and others as appropriate. Keep the ECP commander advised of such notifications.
- ii) Coordinate all activities within the ECP using the expertise available to provide the best assessment of the situation to the ECP commander for decision making.
- iii) Coordinate this emergency plan and any pertinent procedures with other applicable off-site organizations as necessary.
- iv) Maintain current search team rosters and personnel accountability rosters. Ensure personnel are available to fill slots in the emergency organization structure.
- v) Forward a report of each emergency event to RSD for filing.

Health Physics Advisor

The health physics advisor is responsible for the health physics aspects of the emergency. The line of succession and responsibilities of the health physics advisor are as follows:

a) Line of succession

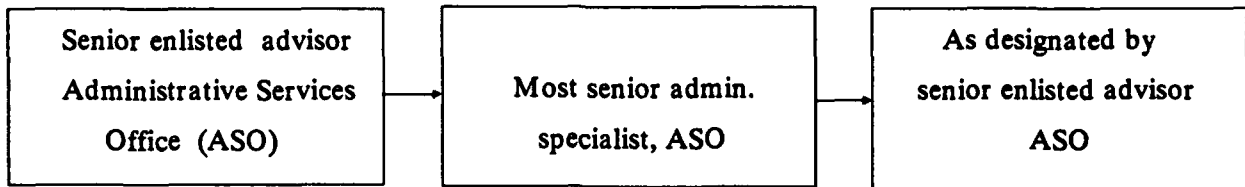


b) Responsibilities

- i) Assist and advise the ECP commander on radiological matters, and help determine the course of further action.
- ii) Coordinate with outside support agencies on radiological matters if necessary.

Search Team Marshal

a) Line of succession



b) Responsibilities

- i) Coordinate with department chairmen on personnel accountability and on the general status of the AFRRI facility immediately after an emergency evacuation.
- ii) Report above information to the ECP commander and to the ERT commander, as applicable.
- iii) Provide ECP search team sweep reports, department muster reports, and any additional personnel or facility reports to the ECP recorder for disposition and filing.

Search Teams

a) Personnel

Personnel and alternates to fill these billets are assigned by the emergency coordinator.

b) Responsibilities

During an evacuation, search teams are responsible for searching their assigned areas for personnel and hazards. The search results are reported to the search team marshall. Search team members will then muster with their department/offices at the emergency muster location.

Medical Advisor

a) Personnel

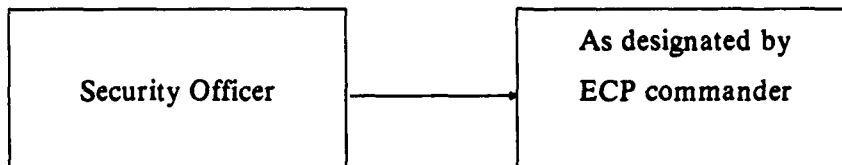
A medical doctor designated by the ECP commander.

b) Responsibilities

- i) Coordinate the medical treatment of injured and/or contaminated personnel.
- ii) Provide medical information as applicable to the ECP/ERT commanders.

Security Advisor

a) Line of succession

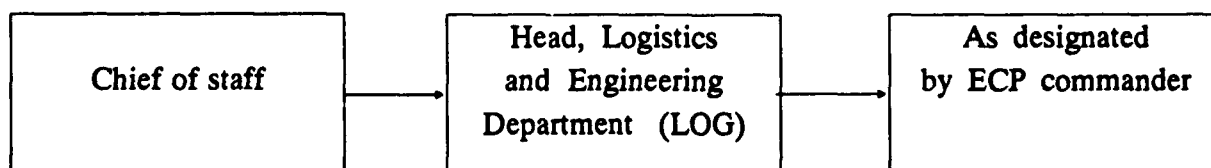


b) Responsibilities

- i) Establish and maintain coordination with security coordinator, as necessary.
- ii) Coordinate security issues with off-site security support as required.
- iii) Perform security duties as directed by the ECP commander.

Logistics Advisor

a) Line of succession

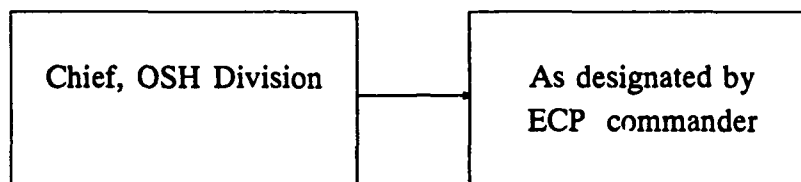


b) Responsibilities

- i) Establish and maintain coordination with ERT commander on Institute facilities, equipment, and systems as directed by the ECP commander.
- ii) Coordinate off-site facilities engineering support as required.
- iii) Perform duties as directed by the ECP commander.

Occupational Safety and Health (OSH) Advisor

a) Line of succession



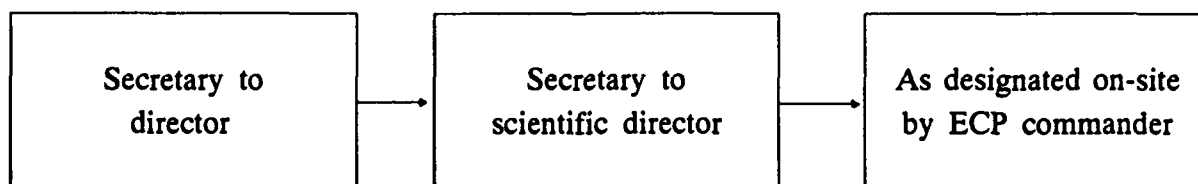
b) Responsibilities

- i) Ensure that appropriate and operable emergency OSH equipment is readily available.
- ii) Provide recommendations, perform research, and provide information on nonradiological hazardous situations.
- iii) Perform duties as directed by the ECP commander.

Recorder for ECP

The secretary to the director is the recorder for the ECP.

a) Line of succession



b) Responsibilities

- i) Log the sequence of events as they occur. Log as much pertinent information as possible, including all decisions made by the ECP commander.
- ii) Forward the log to the emergency coordinator for disposition.

3.1.2 ERT PERSONNEL RESPONSIBILITIES AND DUTIES

ERT Commander

The ERT commander is directly responsible to the ECP commander for implementing, directing, and carrying out actions on-site to assess and correct emergency situations. The ERT commander's sphere of control over activities is normally confined within the site but may carry off-site as necessary.

The ERT commander derives his authority from the ECP commander. Upon activation of this emergency plan, the ERT commander may assemble the manpower pool subteams and direct their activities to assess and correct the emergency situation. The ERT commander is responsible to the ECP commander for all action taken within the Institute and has authority to make on-the-spot decisions and to direct or perform immediate action deemed necessary, provided that the ECP commander is informed of such immediate decisions and action as soon after the fact as possible. The line of succession and responsibilities of the ERT commander are as follows:

a) Line of succession



b) Responsibilities

- i) Establish and direct the ERT organization; establish and maintain close communications with the ECP commander to provide status and emergency information.
- ii) Advise the ECP commander on possible courses of action for dealing with emergency conditions.
- iii) Implement all directives from the ECP commander pertaining to activities within the Institute during an emergency or recovery operation; act as on-scene incident commander for HAZMAT emergencies as specified by 29 CFR 1910.

c) Special qualifications

- i) USNRC-licensed senior reactor operator.

- ii) Site command HAZMAT training completed.

Operations Coordinator

a) Personnel

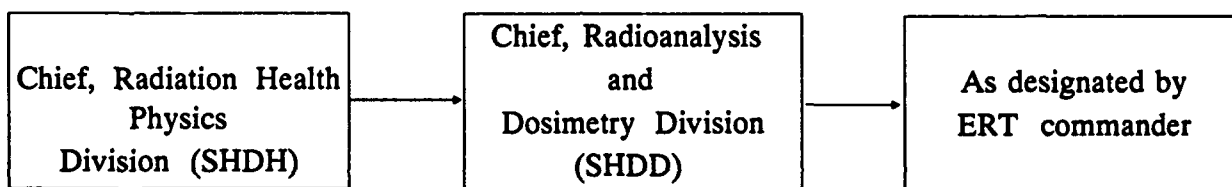
As designated by the ERT commander.

b) Responsibilities

- i) Coordinate all operational actions within the ERT for the ERT commander.
- ii) Provide information, advice, and assistance as requested by the ERT commander pertaining to the activities of ERT personnel.

Health Physics Coordinator

a) Line of succession



b) Responsibilities

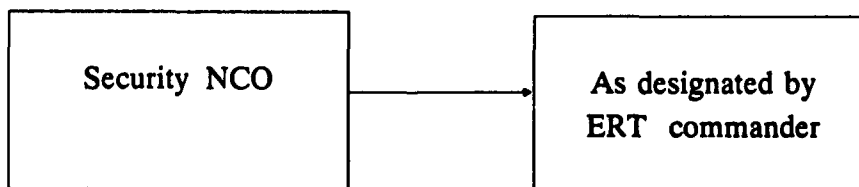
- i) Assess radiological conditions within the Institute and for the direction and coordination of activities of the health physics monitors of the entry team.
- ii) Ensure the availability of emergency health physics monitoring and decontamination equipment.

c) Special qualifications

A background in health physics.

Security Coordinator

a) Line of succession



b) Responsibilities

- i) Direct and control traffic on the roads surrounding AFRRI to ensure quick access for emergency vehicles and equipment.
- ii) Establish and maintain facility boundary security and personnel traffic control at controlled-access points as directed by the ERT commander.
- iii) Secure any area within the AFRRI site boundary as directed by ERT commander.

Special Assessment Coordinator

a) Personnel

As designated by the ERT commander.

b) Responsibility

Perform tasks as assigned and provide information/assistance as requested by the ERT commander.

HAZMAT Coordinator

a) Personnel

As designated by the ERT commander.

b) Responsibilities

- i) Provide information, advice, and assistance pertaining to HAZMAT situations as requested by the ERT commander.
- ii) Assess toxicological (chemical and biohazardous) conditions within the Institute.
- iii) Ensure the availability of chemical testing and decontamination equipment.
- iv) Monitor appropriate cleanup, containment of spills, and testing of air/water.
- v) Consult with medical personnel on necessity of testing individuals exposed to dangerous agents.

c) Special qualifications

- i) HAZMAT and OSH training at the HAZMAT technician level.

ERT Entry Teams

a) Personnel

Each ERT entry team will consist of a reactor staff member, a health physics technician, and an individual capable of providing first aid (medic). Assignment of personnel and alternates to fill these billets is the responsibility of the ERT commander.

b) Responsibilities

ERT entry teams are subordinate to the ERT commander. ERT entry teams shall carry out protective and corrective action as directed by the ERT commander.

Personnel Assets Pool

a) Personnel

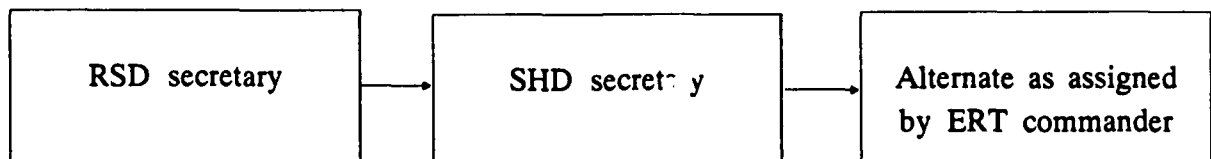
AFRRI personnel selected by the ERT commander.

b) Responsibilities

The personnel assets pool is subordinate to the ERT commander. Members of this pool shall support activities of the ERT as directed by the ERT commander.

Recorder

a) Line of succession



b) Responsibilities

- i) Log the sequence of events, with the time, as they occur in the Institute. Log as much pertinent information as possible.
- ii) Forward the log to the emergency coordinator for disposition.

3.2 INTERFACES BETWEEN AFRRI EMERGENCY ORGANIZATION, OFF-SITE LOCAL SUPPORT AGENCIES, AND FEDERAL AGENCIES

There are no credible events that require direct interaction with off-site governmental agencies except for (1) USNRC; (2) AFRRI's parent headquarters; and (3) NNMC. A block diagram showing the interfaces between the AFRRI emergency organization, off-site local support organizations, and federal agencies is given in figure 3-2.

U.S. Nuclear Regulatory Commission (USNRC)

Title 10, Code of Federal Regulations (CFR), Section 6 of the AFRRI Reactor Technical Specifications outline requirements for the reporting of emergencies to the USNRC. Notification procedures (e.g., telephone and telegraph, mailgram, written reports, etc.) shall be implemented in the AFRRI Emergency Response Guidebook as required by these documents.

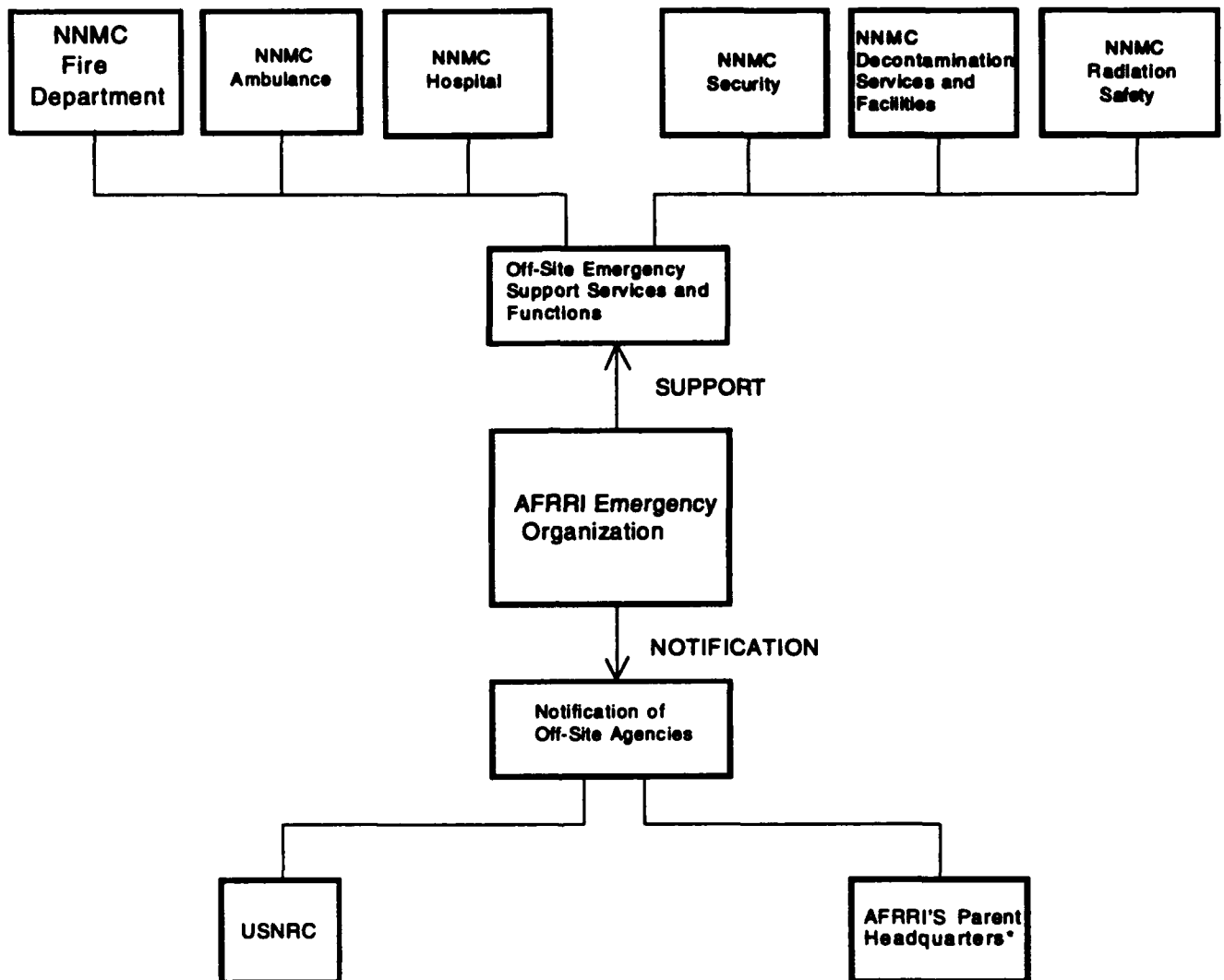
Defense Nuclear Agency (DNA)

The DNA Emergency Operation Office in Alexandria, VA, will be notified in the event of an emergency at AFRRI until 1 October 1993, when USUHS becomes AFRRI's parent organization, and is responsible for notifying other appropriate offices within DNA, such as the DNA General Counsel, DNA Security, and the DNA Public Affairs/Information Office. The DNA Public Affairs/Information Officer will coordinate with the ECP commander all information releases to the news media and the public during or after an emergency or recovery operation through the DNA Emergency Plans Office. These responsibilities will pass to USUHS as of 1 October 1993.

National Naval Medical Center (NNMC)

The NNMC grounds encompass the AFRRI site and, as the host under an interservice support agreement, NNMC provides services and support to AFRRI. NNMC support includes firefighting and rescue resources, ambulance service, major or sustained medical treatment and hospital services, and security response forces. In addition, NNMC can provide emergency assistance/support to AFRRI, as necessary, in such areas as personnel decontamination, radiological assessment, and HAZMAT activities.

To ensure a clear understanding of the emergency support responsibilities of key NNMC support organizations, a written interservice support agreement is in effect with NNMC. A copy of that agreement is included in the AFRRI Emergency Response Guidebook.



*Currently DNA; effective 1 October 1993, the Uniformed Services University of the Health Sciences.

Figure 3-2. Interactions with off-site organizations.

4.0 EMERGENCY CLASSIFICATION SYSTEM AND EMERGENCY ACTION LEVELS

This chapter sets the criteria for classifying emergency situations into classes that involve alerting or activating progressively larger segments of the emergency organization. There are four standard emergency classes. These classes in order of escalation are as follows: Class 1, Notification of Unusual Events; Class 2, Alert; Class 3, Site Area Emergency; and Class 4, General Emergency. To allow for the appropriate response to emergencies that are less severe than Class 1, Notification of Unusual Events, AFRRI has incorporated an additional classification: Class 0, Events Less Severe than the Lowest Category. The emergency classification system is designed to facilitate communication between facility personnel, local on-site emergency support personnel, and federal organizations if necessary.

Based on the radiological dose analysis of the DBA as presented in the SAR, the most severe emergency class that could apply to AFRRI is Class 2, Alert. Thus this emergency plan covers only Class 0, Class 1, and Class 2 emergencies. Each of the three emergency classes addressed by this plan has emergency action levels associated with it. These action levels provide specific trigger points that are intended to activate appropriate portions of the AFRRI emergency organization and initiate protective actions appropriate for the emergency event. Table 4-1 outlines the postulated emergency scenarios and associated emergency actions for each class of emergency applicable to AFRRI.

Table 4-1. Emergency Classification System and Emergency Action Levels.

Class 0	General Scenario Description	Emergency Action Levels
Events Less Severe than the Lowest Category	<p>Events of this classification are generally peripheral to reactor operations and do not necessarily require changing the reactor status. Nevertheless, the reactor might be shut down due to injury of a key individual, to reallocate personnel, or if a potential for escalation is perceived to exist. Similarly, the reactor operations boundary or a specific area within it might be evacuated and/or isolated, as necessary, if, for example, a potential for radiological escalation is deemed to be present.</p>	<p>a) Receipt or notification of vague bomb threats or civil disturbances nonspecific to reactor.</p> <p>b) Observation or notification of personnel injury or disablement within the reactor operations boundary.</p> <p>c) Notification or receipt of officially declared severe weather warning for the immediate area.</p> <p>d) Observation of a small unusual loss or drop of normal reactor pool water that is determined to be within the capabilities of normal makeup water system(s).</p> <p>e) Observation of a minor radiation incident within the operations boundary or alarm(s) below the EAL thresholds identified for a Class 1 emergency condition listed in next section.</p> <p>f) Fire alarm not involving the reactor facility.</p> <p>g) Notification or receipt of an unanticipated reactor facility intrusion detection system alarm(s). (Note: Such events will be acted upon in accordance with the AFRRI Reactor Facility Physical Security Plan, which is protected from public disclosure.)</p> <p>h) Malfunctions of the AFRRI or NNMC physical plant that may adversely affect the Institute.</p>

Table 4-1 (Continued)

Class 1	General Scenario Description	Emergency Action Levels
Notification of Unusual Events	<p>Emergencies that may arise as a result of either man-made events or natural phenomena that are recognized as possessing significant hazard potential. Events in this classification will normally warrant termination or alteration of normal routines and possible evacuation and/or isolation of specific areas.</p>	<p>a) Receipt or notification of bomb threats or civil disturbances specifically directed against the reactor and having potential for radiological release or reactor facility structural damage implications.</p> <p>b) Sustained fire or minor explosion within the operations boundary.</p> <p>c) Official report or observation of imminent severe natural phenomena in the immediate local area which might cause reactor facility structural damage.</p> <p>d) Low pool water level alarm actuation and observation of a significant loss of pool water.</p> <p>e) The unanticipated actuation of the following alarms:</p> <p>(1) R1 radiation area monitor (RAM), 500 mR/hr for 1 minute,</p> <p>(2) R2 RAM, 10 mR/hr for 1 minute,</p> <p>(3) E3 RAM, 10 mR/hr for 1 minute,</p> <p>(4) E6 RAM, 10 mR/hr for 1 minute,</p> <p>(5) R5 RAM, 50 mR/hr for 1 minute,</p> <p>(6) stack gas monitor, 800 times MPC for Ar-41 (unrestricted area) for 1 minute, or</p> <p>(7) the reactor room continuous air monitor (CAM), 10 kcpm for 1 minute.</p>

Table 4-1 (Continued)

Class 2	General Scenario Description	Emergency Action Levels
Alert	<p>This class of emergencies may exist when events have occurred or are in progress that require emergency response to prevent, control, or limit a serious potential or actual radiological hazard. Suspension of the normal routine is strongly indicated, as is evacuation and/or isolation of affected areas, as necessary.</p>	<p>a) Observation of an irradiated fuel element cladding rupture during a fuel handling operation.</p> <p>b) Official report or observation of severe natural phenomena on-site causing damage to the reactor facility.</p> <p>c) Reactor facility fire alarm from a sustained fire (10-minute duration) or explosion (including missile impact) that is determined to have directly compromised the reactor facility structure.</p> <p>d) Low pool water level alarm actuation in conjunction with a loss of pool water which is in excess of the capabilities of the normal and emergency makeup water systems.</p> <p>e) Verified visual observation of extensive fuel damage involving multiple cladding failures (alone), or unanticipated alarms of the reactor room CAM in conjunction with radiation alarms for R1, R2, R5, and/or the stack gas monitor.</p>

Notes:

Unanticipated is used to ensure that the alarm or other threshold indication is associated with a real emergency hazard and not the result of a test or calibration of the system or the result of planned and approved special work permit operations where such alarms or thresholds would be anticipated as a matter of course.

800 times MPC for Ar-41 (unrestricted area) at the top of the stack is equivalent to 2.2×10^{-2} mR/hr at the AFRRI site boundary.

5.0 EMERGENCY RESPONSE

This chapter discusses the generic aspects of the emergency response functions of the AFRRI emergency organization. Specific procedures for assessment actions, activation of the emergency organization, and notification as well as emergency organization billet assignments, call rosters, and detailed facility information are presented in the AFRRI Emergency Response Guidebook. The AFRRI Emergency Response Guidebook is intended to give guidance to the ECP and ERT commanders and other key emergency organization members for dealing with various emergency situations that may affect AFRRI. This chapter describes the general categories of information contained in the AFRRI Emergency Response Guidebook.

Emergency response guidance is provided in the following set of procedures:

1. General Instructions to the First Responder
2. Assessment Action Procedures
3. Activation of Emergency Organization Procedures
4. Emergency Response Implementation Procedures
5. Notification Procedures

The information presented in the AFRRI Emergency Response Guidebook is not limited to the above sequence of procedures; however, it is the essential set of instructions for coping with emergencies.

At AFRRI, emergency response actions to radiological emergencies apply within the emergency planning zone (EPZ). In accordance with USNRC Regulatory Guide 2.6, ANSI/ANS 15.16, and NUREG 0849, the EPZ associated with the reactor is the AFRRI reactor facility operations boundary. The EPZ is completely contained within the confines of the AFRRI site.

5.1 ASSESSMENT ACTIONS

Assessment actions are those actions taken to determine the magnitude of the situation and to provide continuous assessment of the impact of a release of radioactive materials. Because nonradiological emergencies are more likely at AFRRI, assessment actions will also apply to emergencies associated with fires, HAZMAT accidents, personnel injuries, civil disturbances, and natural disasters. Specific occurrences requiring assessment are outlined in the emergency action levels (EALs) presented in table 4-1 of the previous chapter. The assessment actions for each EAL and protective action guides (if necessary) are presented for each class of emergency in the AFRRI Emergency Response Guidebook.

5.2 ACTIVATION OF THE EMERGENCY ORGANIZATION

The minimum working emergency organization will be activated by the ERT commander or, when absent, by the senior reactor operator on duty during normal duty hours and by the officer of the day (OD) or the security guards during off-duty hours upon proper authorization by the ERT commander. Larger segments of the emergency organization will be activated by the ECP commander pending the results of preliminary assessment actions taken by staff on the scene of the emergency. Guidelines, based on the EALs, for alerting or activating progressively larger segments of the emergency organization are presented in the AFRRI Emergency Response Guidebook.

5.3 IMPLEMENTATION PROCEDURES

Implementation procedures are those instructions required to carry out protective and corrective actions. These procedures are developed for each class of emergency in the AFRRI Emergency Response Guidebook.

5.4 NOTIFICATION PROCEDURES

Notification procedures for each class of emergency shall be developed in accordance with 10 CFR 20 and the Technical Specifications for the AFRRI Reactor Facility. These procedures, as found in the AFRRI Emergency Response Guidebook, ensure that the appropriate local, state, and federal officials are notified in the event of an emergency.

6.0 EMERGENCY FACILITIES AND EQUIPMENT

6.1 EMERGENCY COMMAND POST (ECP)

The ECP is the designated area where the ECP commander receives information about the emergency; directs assessment and corrective/protective action to be implemented; requests/summons support; initiates notification of off-site agencies; authorizes and approves information for public release through higher authority; and makes decisions during the course of an emergency. The primary ECP is in the director's office (room 2151), and the secondary ECP is located under the bridge on Palmer Road South.

The ECP is the emergency coordination and decision center. Assessment and corrective/protective action can be implemented from the ECP; however, in most instances the ERT will implement such action. Communication links (via telephone and/or radio) will be established between the ECP and ERT as soon as possible after they are manned. These communication links will be maintained at all times during the emergency.

6.2 EMERGENCY RESPONSE TEAM (ERT) LOCATION

The ERT location is the designated area where the ERT can carry out or coordinate required assessment and protective/recovery action. Due to the availability of radiation monitoring equipment, the primary ERT location will be the reactor control room (room 3160). If the dose rate in the reactor control room is in excess of 100 mR/hr, the integrity of the door seals or windows in the reactor control room is compromised, or the general fire alarm has been sounded, the ERT location will be on the patio by AFRRI's front entrance. Equipment will be drawn from the Emergency Response Center (ERC) (room 3430).

6.3 RADIOLOGICAL ASSESSMENT EQUIPMENT

Within the reactor control room (primary ERT location) are readouts for the following fixed radiation/radiological monitors: four reactor RAMs, two of which monitor the reactor room at various points and two of which are associated with the reactor exposure rooms; two reactor room CAMs, which surveys for airborne radioactive particulates; and a stack gas monitor with associated stack flow monitor which surveys for radioactive gases in the reactor stack. Other radiation/radiological monitors located in the reactor control room will indicate high radiation in the reactor primary coolant loop and high radiation fields at other points within the reactor facility operations boundary. Also located within the reactor control room

are portable radiation survey meters, one of which shall be a high range unit (up to about 300 R/hr).

The majority of the emergency assessment equipment, including first aid and decontamination supplies, and meteorological data readouts are contained in the ERC. Portable emergency radiation survey meters and other emergency equipment are located at selected points in AFRRI in transportable emergency caches. The security room near the ERC has the read out panel for the facility fire alarm. This panel provides information on fire alarm locations throughout the facility.

Available elsewhere within AFRRI, but outside of the reactor facility operations boundary, are other portable and fixed radiation survey and assessment equipment, air samplers, and multichannel analyzers with various detectors that are capable of providing radioisotopic analysis.

6.4 DECONTAMINATION, FIRST AID, AND MEDICAL FACILITIES

6.4.1 DECONTAMINATION FACILITIES

AFRRI has on-site facilities and manpower for decontamination. NNMC has additional decontamination facilities that are available to AFRRI in an emergency. Within the confines of the reactor building (both within and outside the reactor operations boundary) are several decontamination sinks and showers with warm drains. In addition, there are other sinks with blockable cold drains that could be used for short-term or minor decontamination. Within the reactor room, as well as just outside the reactor control room (primary ERT), are decontamination supplies for short-term confinement of minor spreadable contamination. The Safety and Health Department maintains personnel, equipment, and supplies to handle major radioactive contamination problems and decontamination efforts. Protective clothing is located in the portable and fixed emergency caches located throughout AFRRI. Self-contained breathing equipment (industrial air masks/air packs) is stored adjacent to these caches.

If injured and/or contaminated personnel cannot be decontaminated and/or treated at AFRRI, those individuals would be appropriately prepared and transported by ambulance to the NNMC hospital, which has full hospital emergency facilities to handle personnel decontamination. Preparation of individuals for transport will be done by SHD. The NNMC hospital is located approximately 500 meters from the AFRRI complex.

6.4.2 FIRST AID

The on-site staff includes medically trained personnel and at least one medical doctor. Responding NNMC fire and ambulance personnel are also trained to provide first aid. Immediate first aid will be provided by the first available trained individual, with subsequent on-site treatment provided by paramedical and medical personnel. Major medical treatment will be performed at the NNMC hospital.

The AFRRI medical staff will be notified of personnel injury on-site by telephone, public address system, or radio. Ambulance and medical services will be requested by telephone or radio. Transport of injured personnel will be by ambulance. Preparation of an individual for transport will be in accordance with internal procedures.

An industrial first aid kit is located just outside the reactor control room (primary ERT location). A full medical bag, oxygen supply, and wheelchairs are available in the ERC.

6.4.3 AMBULANCE SERVICE

NNMC-contracted ambulance service will be used for transport of injured and/or contaminated personnel to the NNMC hospital. For transport of a contaminated individual, a health physics member of SHD will accompany the individual in the ambulance to advise paramedics on proper handling, to minimize personnel exposures and the spread of contamination, and to provide estimated exposure information.

6.4.4 NNMC HOSPITAL

The NNMC hospital complex handles all emergency cases on the base, and it is a designated and certified radiation accident emergency facility capable of handling radiation-exposed and contaminated victims. Training of hospital personnel is performed on a continual basis at NNMC. The NNMC hospital has its own radiation safety office staffed with personnel who are trained in radiation assessment and control techniques.

6.5 EMERGENCY COMMUNICATIONS

Primary emergency communications between the primary ECP and ERT locations will be by telephone. Primary emergency communication between the secondary ECP and ERT locations will be by radio.

There is at least one telephone at each of the potential ECP or ERT locations. With the addition of mobile cellular phones owned by AFRRI, this number can be increased. The primary ERT location has an intercom system that links the reactor control room to areas within the reactor facility operations boundary. This system is used on a routine basis for communications between the reactor control room, the reactor room, the dosimetry readout room, and the reactor prep area. All locations associated with this intercom system have the capability to both transmit and receive.

The AFRRI front desk controls the public address system. This system transmits only from the front desk but has reception capability throughout AFRRI. Public address systems are also available in NNMC security vehicles and at least one portable loudspeaker (bullhorn) is available for use at the ECP or ERT location.

An alternate communication system, totally independent of ground links, is available for emergency use. This system uses self-powered, hand-held radio units, several of which are designated emergency units and are kept at the primary ERT location. These radios operate on a common dedicated frequency assigned to AFRRI, and will be used as the primary means of emergency communications on-site whenever the secondary ECP and ERT locations are used. Additional radios are available from the Logistics and Engineering Department.

The primary communication units (telephones) are used daily for normal operations. If found inoperative, they will be repaired by NNMC telephone services. The alternate units (radios, bullhorn, and public address/intercom system) will be tested on a regular basis by the reactor staff, and power pack changes will be made in accordance with manufacturer recommendations.

6.6 ON-SITE EMERGENCY CACHES

Emergency cache units are located at various points in the AFRRI complex. One of these emergency caches is located at the ERC and is available for use at both the primary and secondary ERT locations. Emergency caches are also located on the third floor of stairwell 3317 and in hallway 3106. These units are portable.

Emergency equipment necessary to support emergency action on-site and to permit entrance to an airborne contamination area are contained within these emergency cache units. A fixed emergency cache is located near the primary ERT location and will provide equipment for immediate emergency support.

Emergency cache units will be inventoried quarterly, not to exceed four months, by SHD. Any equipment due for calibration will be exchanged for calibrated equipment. A list of required equipment is provided in the AFRRI Emergency Response Guidebook.

7.0 RECOVERY OPERATIONS

Downward classification of an emergency, to include emergency termination, can only be authorized by the ECP commander based on the predetermined EALs cited in chapter 4 of this plan and the results of assessment actions described in the AFRRR Emergency Response Guidebook.

Recovery procedures will be implemented by the ECP commander as described in the AFRRR Emergency Response Guidebook. A recovery plan must be tailored to the actual situation, as it existed, and to the emergency conditions that were experienced. Recovery plans that are written and approved will include specific considerations of contamination levels, identified hazards, as well as radiation levels. Decontamination, if required, shall conform to the provisions of 10 CFR 20 and internal SHD health physics procedures.

8.0 MAINTAINING EMERGENCY PREPAREDNESS

This chapter describes the elements necessary for maintaining an acceptable state of emergency preparedness. Provisions have been made for maintaining the effectiveness of this emergency plan, including radiological and HAZMAT training, review and update of the emergency plan and associated implementing procedures, and maintenance and inventory of equipment and supplies used in emergencies.

8.1 INITIAL TRAINING AND PERIODIC RETRAINING PROGRAM

An initial emergency response training and periodic retraining program will be conducted to maintain the ability of emergency response personnel to perform their assigned functions. Programs to train and requalify personnel for participation in the emergency plan are as follows:

- i) All licensed reactor operators (RO) and senior reactor operators (SRO) will receive training on this plan and the AFRRI Emergency Response Guidebook as described in the operator and requalification program. New SROs and ROs will receive extensive emergency plan training as part of the TRIGA Reactor Operator Training and Requalification Program.
- ii) Emergency management staff, along with other key staff personnel are required to annually review this plan and the AFRRI Emergency Response Guidebook.
- iii) All personnel are required to attend an annual safety briefing, which covers general responses to emergency conditions.
- iv) Security personnel (officer of the day and the security watchmen) will receive a briefing on emergency response and the emergency plan annually.
- v) NNMC Security and Fire Department personnel will receive an orientation and familiarization tour of AFRRI on an annual basis. Training/certification of NNMC emergency, security, medical, and radiation safety personnel is conducted by NNMC under pertinent military regulations.
- vi) ERT training will be conducted on a quarterly basis. This quarterly training need not involve the entire ERT. All ERT personnel will receive training in general emergency functions at least annually. Specific training requirements are addressed in the TRIGA Reactor Operator Training and Requalification Program.

- vii) All members of the ERT will receive a briefing on initial response actions to HAZMAT emergencies. Some ERT members will receive HAZMAT emergency response training at the HAZMAT technician level. At least one senior member of the emergency organization will be qualified as a site commander for HAZMAT emergencies. Staff will comply with training requirements set forth by 29 CFR 1910 for response to hazardous materials situations.

8.2 EMERGENCY DRILLS

Emergency drills to test the effectiveness of the emergency plan and the emergency organization will be conducted as follows:

- i) Annually, not to exceed 15 months, on-site emergency drills will be conducted as action drills. Each required emergency measure will be executed as realistically as is reasonably possible. The appropriate emergency equipment will be used by the emergency organization.
- ii) Every other year the annual action drill will involve a simulated emergency scenario to test the preparedness and response of the full on-site emergency response organization, and to an appropriate extent, off-site personnel, services, and equipment.
- iii) The emergency scenario will be developed, planned, and exercised by the ERT commander in conjunction with assigned observers chosen by the emergency coordinator. An invitation will be extended to non-AFRRRI members of the RRFSC to participate as planners or observers for the drill. The planners of the drill will not participate in the drill, and the scenario will not be published prior to the drill.
- iv) Off-site (e.g., NNMC) emergency personnel, services, and equipment will be called upon, used, or included in the drill as appropriate and necessary. As a minimum requirement, communication links and notification procedures will be tested once every 2 years.
- v) After each drill, there will be a debriefing, at which time observers will critique the drill. The critiques will then be evaluated by the facility emergency response personnel. Any deficiencies identified in the emergency plan, the implementing procedures, or their actual use during the drill will be reviewed and corrected as appropriate.

8.3 EMERGENCY PLAN REVIEW AND UPDATE

This emergency plan and the AFRRRI Emergency Response Guidebook will be reviewed annually, not to exceed 15 months. Updates and changes to the AFRRRI Emergency Response Guidebook will be reviewed by the RRFSC. The annual

review of the plan will also encompass a review of any support agreements and off-site emergency telephone numbers. The emergency coordinator is responsible for ensuring that this annual review is conducted.

Copies of this emergency plan shall be provided to designated off-site (NNMC) emergency response units as a matter of course. In addition, copies of this emergency plan and the AFRRI Emergency Response Guidebook, shall be readily available (as a minimum) to AFRRI security force personnel, reactor staff personnel, SHD personnel, the directorate, and higher authority.

8.4 EQUIPMENT MAINTENANCE AND INVENTORY

The operational readiness of all emergency equipment is ensured by a routine maintenance program. Emergency supplies and equipment shall be routinely inventoried and verified to be operational and complete. Fire extinguishers, located throughout the AFRRI complex, are also routinely checked on an annual basis by the NNMC Fire Department. The reactor annunciator/alarm box (which provides audible and visual alarms during the nonduty hours for low reactor pool water, high airborne radiation in the reactor room, and a high radiation field in the reactor room) is located outside the reactor facility operations boundary in hallway 3101 near the AFRRI front desk, and is verified to be operational on a quarterly basis by the reactor staff who also maintain it.

Telephone and radio communication equipment maintenance is provided by NNMC utility services or the manufacturer of the equipment, as necessary and appropriate. Emergency radios are routinely inventoried and verified to be operational by the reactor staff on a regular basis. Fixed on-site public address systems are used by (a) the reactor staff within the reactor facility operations boundary and (b) the security watchmen for announcement throughout AFRRI on a routine day-to-day operational basis, as required. Surveillance of these systems occurs as a result of their daily use, and any required maintenance is performed by the Logistics and Engineering Department. All other off-site (NNMC) emergency supplies and equipment are inventoried and maintained by NNMC in accordance with their own procedures.

Maintenance and calibration of the reactor facility radiation safety and radiation detection/measuring equipment are conducted in accordance with table 8-1. Surveillance/testing is performed on a routine basis and whenever the system(s) are used.

An inventory list of the minimum required emergency equipment is provided in the AFRRI Emergency Response Guidebook.

Table 8-1. Maintenance/calibration schedule for reactor facility safety and radiation detection/measuring equipment.

Equipment	Minimum Maintenance or Calibration Frequency	Basis for Requirement
Reactor radiation area monitors (RAMs)	Quarterly	Technical specification
Reactor room continuous air monitor (CAM)	Quarterly	Technical specification
Reactor stack gas monitor	Annually	Health physics procedures
Portable survey monitors/meters	Quarterly	Health physics procedures
Radioanalysis equipment	Quarterly	Health physics procedures
AFRRI RAMs	Annually	Health physics procedures
AFRRI CAMs	Annually	Health physics procedures
Fire Alarm	Annually	LOG procedures

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